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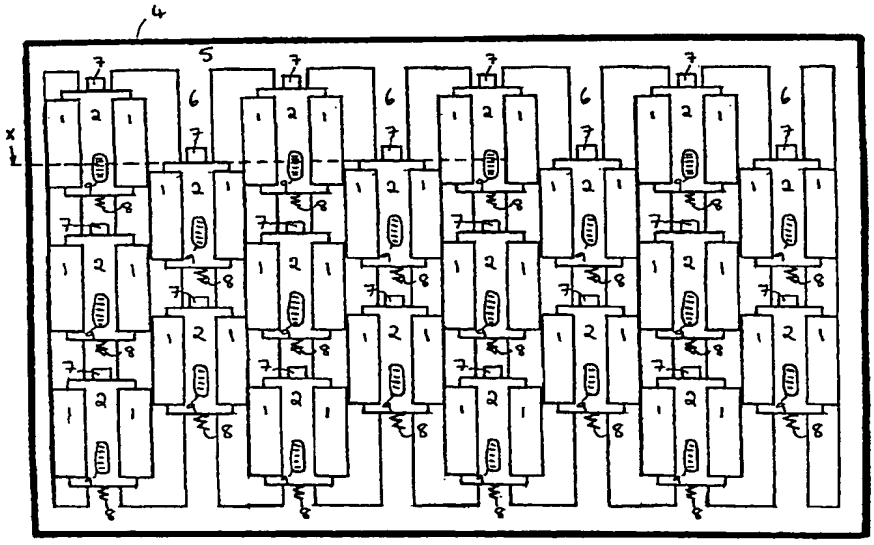

(57) Abstract: A printhead cartridge for a multi-printhead ink jet printer includes an array (3) of ink jet nozzles and a reference surface Z for locating the cartridge in the printer. The cartridge also includes a data carrier, such as a bar code (9), which carries a measurement (z) of the location of the first ink jet nozzle (10) in the array (3) relative to the reference surface (Z) of the cartridge. The measurement information allows the manufacturing tolerances for the cartridge to be reduced because any misalignment of the nozzle array (3) in the (z) direction can be compensated by delaying the print signal to the nozzle array (3).

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CARTRIDGE WITH BAR CODE COMPRISING ENCODED ALIGNMENT DATA

The present invention relates to printing and in particular to printing using a multi-printhead ink jet printer formed from a plurality of printheads and which is wide enough to print across the full width of a continuous substrate.

A multi-printhead printer may be used in so-called "drop on demand" ink jet printing to print onto a continuous substrate, for example to print directly onto packaging in a production line. In this case, the printer may be arranged opposite a transport mechanism for the substrate, such as a part of the production line. Such printing is particularly attractive in the production of packaging because it is possible to package items from the same production run into packaging with a different appearance without stopping the packaging line. Thus, for example, the packaging printer may print packaging in one language for the first hundred units and then switch to print packaging in a different language for the next hundred units. Alternatively, the printer may switch from printing the packaging bearing one customer's trade marks to printing those of another. In either case, it is not necessary for a continuous production line to stop for the outer packaging to be changed, and this saves time and therefore money in the production process.

A multi-printhead ink jet printer comprises a very large number of densely packed nozzles through which ink is ejected onto the printing substrate to form the printed image. The spacing between nozzles can be around 140 microns to give a pixel density of 180 dpi. It is extremely important that the ink jet nozzles are accurately located relative to each other, as a very small misalignment of even one nozzle can produce a

noticeable effect on the printed image.

In order to achieve a desired print density, the ink jet nozzles may be interleaved, i.e. one row of nozzles may be arranged to print pixels between the pixels printed by a second row of nozzles. Interleaving of nozzles increases the requirement for accurate location of the nozzles. The nozzles can be required to be located to an accuracy of ±10 microns.

Furthermore, if it is desired to print in colour, the locations of the nozzles for each of the different coloured inks must be coordinated with the required degree of accuracy. Many different coloured inks may be used for a full colour industrial printing process, and even in simple situations several colours may be used.

A multi-printhead ink jet printer can be made up of a plurality of printheads, for example in the form of cartridges which fit together to form the whole printer. Such printheads are available from XaarJet Limited of Cambridge, United Kingdom. Such a multi-printhead printer has the advantage that failed ink jet printheads can be replaced without replacing the whole printer. In order that the whole printer is wide enough to cover the width of a desired substrate, the printheads are "stitched" together, so that the printheads overlap in the direction perpendicular to the direction of transport of the substrate.

In a continuous production process, it is extremely undesirable for the production line to be delayed while a printhead is replaced. It is therefore desirable that printheads are replaceable quickly and with the minimum of skill so that the printer can be attended by a relatively unskilled worker who does not delay the production line unduly while replacing a printhead. Nevertheless, each of the interleaved and stitched printheads for each colour of ink must remain accurately aligned after replacement in order to achieve acceptable printing results.

In order to address the problem of aligning printheads, known printheads are provided with designated datum surfaces which are intended to abut against corresponding reference surfaces on a printer chassis to locate the printhead relative to the chassis. However, extremely tight manufacturing tolerances are required for the datum surfaces of the printheads in order that the cumulative tolerances for the location of the ink jet nozzles relative to one another are guaranteed to be within the required range so that acceptable printing results are achieved. This has required extremely accurate, and therefore expensive, manufacturing equipment for the printheads to reduce the printhead tolerances so that the cumulative tolerances for the multi-printhead printer are within the required limits.

The present invention seeks to address this problem and provides a printhead for a multi-printhead ink jet printer, the cartridge comprising at least one array of ink jet nozzles and at least one reference surface for locating the cartridge in a multi-printhead printer, wherein the cartridge further comprises a data carrier including data representative of a measurement of the location of a reference point of the array of ink jet nozzles relative to the reference surface of the particular cartridge.

Thus, according to the invention, each printhead cartridge includes a data carrier on which is stored a measurement of the location of the array of ink jet nozzles relative to a reference surface that is used to locate the cartridge within the multi-printhead printer. The exact position of the array on the cartridge is known and the actual misalignment between the cartridges can be calculated, rather than relying on a guaranteed maximum value from the manufacturing tolerances to ensure that any misalignment is within acceptable limits. In this way, the assembly tolerances for the

cartridges can be reduced without affecting overall printing quality.

With the cartridge according to the invention, when a cartridge needs to be replaced, the operator of the printer can simply read the data carrier of the new cartridge, provide the measurement data to a printer controller and insert the new cartridge in place of the old one.

Viewed from a further aspect, the invention provides a method of manufacturing a printhead cartridge for a multi-printhead ink jet printer, the cartridge comprising at least one array of ink jet nozzles and at least one reference surface for locating the cartridge in the multi-printhead printer, wherein the method comprises the step of measuring the location of a reference point of the array of ink jet nozzles relative to the reference surface of the cartridge and providing the cartridge with a data carrier including data representative of the measurement.

In a preferred arrangement, the measurement represents the location of the array of ink jet nozzles relative to the reference surface in the direction (the z-direction) of movement of a substrate on to which the printer prints, in use. Thus, the measurement may represent the distance from the reference surface to a reference point of the array of ink jet nozzles in a direction (the z-direction) substantially perpendicular to a longitudinal direction of the array, i.e. the direction of the width of the substrate, in use. In this case, the printer controller can delay the ejection of ink droplets from the ink jet nozzles in order to compensate for any misalignment of the array of ink jet nozzles relative to the reference surface, as indicated by the data. Thus, the assembly tolerance of the printhead cartridge can be significantly reduced in the z-direction.

Viewed from a yet further aspect, the invention

provides a multi-printhead ink jet printer comprising a plurality of printhead cartridges removably mounted in a chassis and each comprising a plurality of ink jet nozzles and a printer controller for controlling the ejection of ink from the ink jet nozzles, wherein the printer controller is configured to control the timing of the ejection of ink from the nozzles of each printhead cartridge by reference to the location of the nozzles relative to the printhead cartridge in the direction of movement of a substrate, in order to compensate for misalignment of the nozzles in the said direction.

Viewed from another aspect, the invention provides a method of compensating for misalignment of ink jet nozzles in a multi-printhead printer comprising a plurality of printhead cartridges removably mounted to a printer chassis, wherein the timing of the ejection of ink from the nozzles of each printhead cartridge is controlled by reference to the location of the nozzles relative to the printhead cartridge in the direction of movement of a substrate.

The reference surface may be any accurately defined surface of the cartridge. The reference surface is preferably a surface of the cartridge which engages a corresponding surface of a chassis of the multi-printhead printer when the cartridge is located in the printer. In the preferred embodiment, the reference surface is flat. However, the reference surface may be any suitable shape, for example curved or angular. The reference surface may be arranged to matingly engage with a complementary surface of the chassis of the printer.

The cartridge may comprise a plurality of reference surfaces. The reference surfaces may be mutually perpendicular. In the preferred embodiment, the cartridge has a z reference surface which locates the cartridge in the direction of movement of a substrate

(the z-direction), a y reference surface which locates the cartridge in the direction perpendicular to the surface of the substrate (the y-direction), and an x reference surface which locates the cartridge in the direction perpendicular to the z- and y- directions.

In the case of a cartridge with a plurality of reference surfaces, the data carrier may include data representative of a respective measurement of the location of a reference point of the array of ink jet nozzles relative to each reference surface of the cartridge.

Similarly, the cartridge may comprise a plurality of arrays of ink jet nozzles. In the preferred embodiment, the cartridge comprises two arrays of ink nozzles, which are interleaved. In the case of a plurality of arrays, the data carrier may include data representative of a measurement of the location of each array relative to the reference surface or to respective reference surfaces.

The data carrier may take any suitable form. In the simplest arrangement the data carrier may be in the form of printing, writing or embossing on the cartridge. Preferably, the data carrier is in the form of a label or tag on the cartridge. The data carrier need not be physically attached to the cartridge and may simply be provided with the cartridge or with the packaging of the cartridge.

The data carrier may be human-readable. For example, the measurement may be written on the data carrier. In a preferred arrangement, the data carrier is machine-readable, for example in the form of a bar code or the like. Alternatively, the data carrier may be in the form of a magnetic, optical or electronic storage device.

The data representative of the measurement may be in any suitable form. In the simplest arrangement, the data is the value of the measurement in an appropriate

unit of measurement, for example microns. However, the data may be encoded so that it is not understandable to the operator. This is advantageous in that it may not be desirable to provide easily to the users of a printer information which demonstrates the variability in the manufacturing process of the cartridge. Furthermore, encoded data may be used to prevent the use of unauthorised cartridges in the printer, for example recycled cartridges or poor quality copies.

The data may include other information as well as the measurement, such as a date of manufacture of the cartridge or a serial number.

The data stored on the data carrier may itself not include the measurement, but may be a unique identifier of the cartridge which references the measurement value in a database. Such a database may be local to the printer or may be remote therefrom. In the case of a remote database, the database may be maintained by the cartridge manufacturer and may be accessed over a remote communications link, for example via the Internet. Such a system may be advantageous for the cartridge manufacturer, as it provides information as to customer usage of cartridges.

The measurement may be carried out in any suitable manner. For example, a manual inspection of the array of ink jet nozzles may be carried out after the manufacture of the cartridge using a microscope or similar optical device. Alternatively, the measurement may be carried out automatically, for example using a computer with optical recognition capabilities to identify the position of the array of ink jet nozzles. During the measurement process, the cartridge may be held in a jig which engages the reference surface(s) in a manner corresponding to that of the chassis of the printer when the cartridge is in position.

The reference point may be any suitable, identifiable point of the array of ink jet nozzles. A

reference point, such as a marker, may be added to the array of ink jet nozzles as part of the manufacturing process. However, the addition of such a marker adds another manufacturing tolerance to the cartridge. Thus, in the preferred embodiment, the reference point is one of the ink jet nozzles, for example the first nozzle in the array.

The invention extends to a printer comprising a plurality of cartridges as described above. Such a printer may further comprise a printer controller for controlling the operation of the printer. The printer controller may comprise a data input device for entry of the data from the cartridge when a cartridge is inserted in the printer. In a simple arrangement, the data input device may be a keypad or keyboard by means of which the data may be typed by the operator of the printer. Where the data is in a machine-readable form the data input device may be a suitable reader, such as a bar code reader.

In a particularly advantageous arrangement the data input device may be so arranged that the data is automatically read when the cartridge is inserted into the printer. One possibility for this arrangement is that the data is stored electronically on the cartridge and the data input means makes electrical contact with the data carrier when the cartridge is inserted into the printer.

An embodiment of the invention will now be described by way of example only and with reference to the accompanying drawings in which:

Figure 1 shows schematically a plan view of a multi-printhead printer according to an embodiment of the invention; and

Figure 2 shows schematically an enlarged elevation of a single cartridge of the printer of Figure 1 viewed in cross-section along the line A-A of Figure 1.

Figure 1 shows a multi-printhead printer according

to an exemplary embodiment of the invention which is intended for printing onto a continuous web of material such as paper or cardboard. The printer comprises 20 cartridges (shown in more detail in Figure 2), each of which is made up of two 92 mm wide printheads 1 mounted to a common support 2. Each printhead 1 comprises a 70mm wide array 3 of 500 ink jet nozzles at its lowermost end, and contains an arrangement of miniature valves for controlling the ejection of ink through the nozzles. An ink supply (not shown) is connected to the printhead 2 at its upper end. The array 3 of ink jet nozzles on each printhead 1 has an effective printing density of 180 dpi. The two printheads 1 are interleaved on the support 2 such that the nozzles of the array 3 of one printhead 1 are offset relative to the nozzles of the array 3 of the other printhead 1 by half the distance between adjacent nozzles. In this way, one printhead 1 is able to print pixels between the pixels printed by the other printhead 1. This gives an effective print density for the whole cartridge of 360 dpi.

The printer comprises a chassis 4, to which each cartridge is mounted in a precise location. The chassis 4 comprises an outer, rectangular frame 5 across which run a plurality of horizontal bars 6 to which the cartridges are mounted. The bars 6 are perpendicular to the direction of movement of the substrate (the z-direction) when the printer is in the position of use. On each bar 6, adjacent the location of each cartridge is provided a stop 7 which limits the movement of the cartridge in the direction along the bar 6 (the x-direction). The support 2 of each cartridge is urged against the respective stop 7 by a resilient member 8 represented schematically in Figure 1 by a spring.

As shown most clearly in Figure 2, each cartridge straddles a bar 6, with one printhead 1 on either side of the bar 6. The lower surface of the support 2

engages with the upper surface of the bar 6 to locate the cartridge in the direction perpendicular to the surface of the substrate (the y-direction) and the inner surface of one printhead engages with a lateral surface of the bar 6 to locate the cartridge in the z-direction.

In order for printing to be possible across the full width of the printer, adjacent rows of cartridges are "stitched", i.e. arranged so that the arrays of nozzles of cartridges which are adjacent in the x-direction align to form effectively a continuous array of nozzles. Alternatively, "soft striping", i.e. an overlap of the arrays of nozzles in the x-direction, may be used to disguise small alignment errors between cartridges. Either arrangement allows the whole width of the substrate to be covered continuously by the ink jet nozzles even though the width of the printheads 1 is greater than the width of the array 3 of ink jet nozzles that they carry.

The arrangement of cartridges shown in Figure 1 is intended for four-colour (yellow, magenta, cyan, black) printing with a respective row of three cartridges stitched or soft-striped with the adjacent row of two cartridges for each colour. Thus, the four colours are printed by respective rows of cartridges sequentially in the z-direction. For printing with a greater number of colours, it is necessary only to increase the number of rows of cartridges. To increase the width of the printing, it is necessary to increase the number of cartridges in each row.

In order for acceptable printing to be carried out using the printer shown in Figure 1, each of the cartridges must be accurately located relative to the other cartridges in order that all of the printed pixels correctly register with each other. To this end, the location of each of the arrays of ink jet nozzles is monitored as described below by a print controller (not shown) to ensure that the overall pixel positions remain

within acceptable tolerances.

The reference surfaces for the location of an example cartridge are indicated by dotted lines in Figures 1 and 2 and are:

- the lateral surface X of the support 2 which engages the stop 7 (x reference surface);
- the lower surface Y of the support 2 which engages the upper surface of the bar 6 (y reference surface); and
- the inner surface Z of one printhead which engages an outer surface of the bar 6 (z reference surface).

Each cartridge bears a bar code 9, represented schematically in Figure 1, which includes encoded data of the location of the first ink jet nozzle in the array 3 of each printhead 1 of the cartridge relative to the z reference surface. The bar code 9 is applied to the cartridge as one of the final steps in the manufacturing process. Once the cartridge has been assembled, it is placed in a jig which corresponds to one of the bars 6 of the printer chassis 4 and the distances x, y and z from the x-, y- and z-reference surface respectively to the first hole 10 of each array 3 of ink jet nozzles are measured. The distances in the x and y directions must be within acceptable tolerances, and this is checked as a quality control task. The z distance must also be within an acceptable tolerance but the tolerance here can be more generous because it is possible to compensate any errors by varying the timing of the ejection of ink from the nozzles during printing. In order to correctly calculate the timing, the print controller requires the z measurement and thus this measurement for each array 3 encoded onto the bar code 9. It has been realised that it is more time-effective to measure the location of the array of ink jet nozzles relative to the reference surface as part of the manufacturing process and include this information in

the bar code 9 than to require the, potentially time-consuming, measurement to be made each time a cartridge is replaced which could involve significant delays of a production line.

The information from the bar codes 9 is read by a bar code reader (not shown) which passes the information to the print controller. The print controller compensates for the error in the position of the array of nozzles in the z direction by reducing or increasing the delay of the print signal to the nozzles. For example, if the measurement indicates that the array is mislocated towards the oncoming substrate when the cartridge is in position in the printer chassis 4, the print signal is provided to that array of nozzles earlier than if the array had been perfectly located, so that the ink is ejected while the required portion of the substrate is below the array of nozzles. Similarly, if the z measurement indicates, that the array is mislocated away from the oncoming substrate, the print signed is provided to that array later than for a perfectly located array. In this way, errors in the z location of each array on the cartridge are compensated. It is assumed that the nozzle array 3 is perpendicular to the z direction and that the relative position of each nozzle in the array is correct.

Were it not for the information on the bar codes 9, the assembly tolerance of the z-position of the arrays 3 of ink jet nozzles relative to the fixed reference surface would have to be relied upon to ensure that the required printing accuracy is achieved. However, using the measurement information in the bar codes 9, errors in the location of the arrays 3 in the z-direction can be compensated. In this way, the manufacturing tolerances for the cartridges can be reduced without affecting overall printing quality.

In summary, a printhead cartridge for a multi-printhead ink jet printer includes an array 3 of ink jet

nozzles and a reference surface Z for locating the cartridge in the printer. The cartridge also includes a data carrier, such as a bar code 9, which carries a measurement z of the location of the first ink jet nozzle 10 in the array 3 relative to the reference surface Z of the cartridge. The measurement information allows the manufacturing tolerances for the cartridge to be reduced because any misalignment of the nozzle array 3 in the z direction can be compensated by delaying the print signal to the nozzle array 3.

Claims

1. A printhead cartridge for a multi-printhead ink jet printer, the cartridge comprising

at least one array of ink jet nozzles and

at least one reference surface for locating the cartridge in a multi-printhead printer,

wherein the cartridge further comprises a data carrier including data representative of a measurement of the location of a reference point of the array of ink jet nozzles relative to the reference surface of the particular cartridge.

2. A cartridge as claimed in claim 1, wherein the reference surface locates the cartridge in the direction of movement of a substrate, in use.

3. A cartridge as claimed in claim 1 or 2, wherein the measurement is in a direction which is substantially perpendicular to a longitudinal direction of the array.

4. A cartridge as claimed in any preceding claim, wherein the cartridge comprises a plurality of reference surfaces and the data carrier includes data representative of a respective measurement of the location of a reference point of the array of ink jet nozzles relative to each reference surface of the cartridge.

5. A cartridge as claimed in any preceding claim, wherein the data carrier is machine-readable, in particular in the form of a bar code.

6. A cartridge as claimed in any preceding claim, wherein the data is encoded.

7. A cartridge as claimed in any preceding claim,

wherein the reference point is one of the ink jet nozzles.

8. A printer comprising a plurality of cartridges as claimed in any preceding claim.

9. A printer as claimed in claim 8, further comprising a printer controller for controlling the operation of the printer and a data input device for entry of the data from the data carrier.

10. A method of manufacturing a printhead cartridge for a multi-printhead ink jet printer, the cartridge comprising at least one array of ink jet nozzles and at least one reference surface for locating the cartridge in the multi-printhead printer, wherein the method comprises the step of measuring the location of a reference point of the array of ink jet nozzles relative to the reference surface of the cartridge and providing the cartridge with a data carrier including data representative of the measurement.

11. A method as claimed in claim 10, wherein the measurement is made along a direction which is substantially perpendicular to a longitudinal direction of the array.

12. A multi-printhead ink jet printer comprising a plurality of printhead cartridges removably mounted in a chassis and each comprising a plurality of ink jet nozzles and a printer controller for controlling the ejection of ink from the ink jet nozzles, wherein the printer controller is configured to control the timing of the ejection of ink from the nozzles of each printhead cartridge by reference to the location of the nozzles relative to the printhead cartridge in the direction of movement of a substrate, in order to

compensate for misalignment of the nozzles in the said direction.

13. A printer as claimed in claim 12 wherein the printhead cartridges are as claimed in any of claims 1 to 7.

14. A method of compensating for misalignment of ink jet nozzles in a multi-printhead printer comprising a plurality of printhead cartridges removably mounted to a printer chassis, wherein the timing of the ejection of ink from the nozzles of each printhead cartridge is controlled by reference to the location of the nozzles relative to the printhead cartridge in the direction of movement of a substrate.

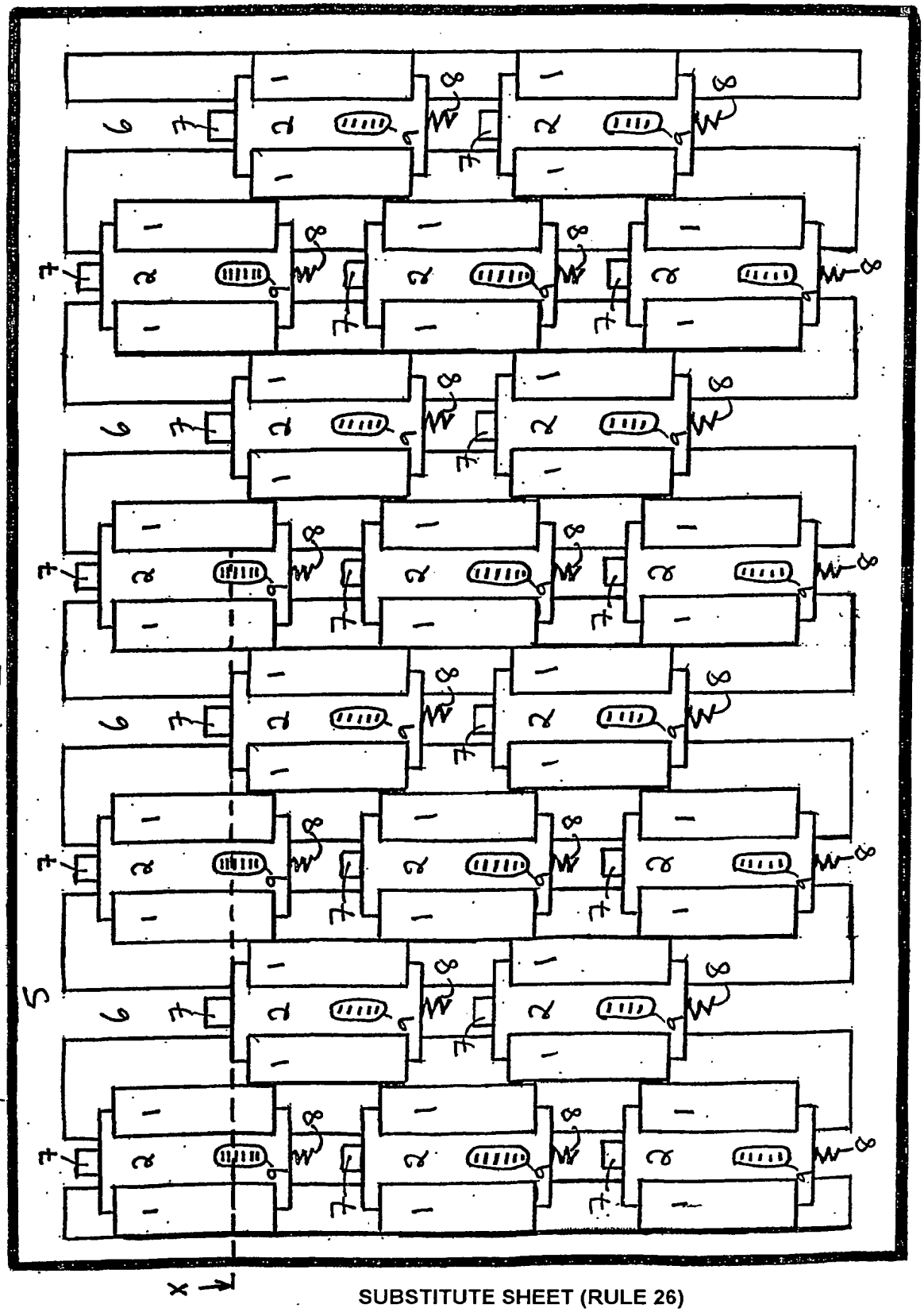

FIG. 1

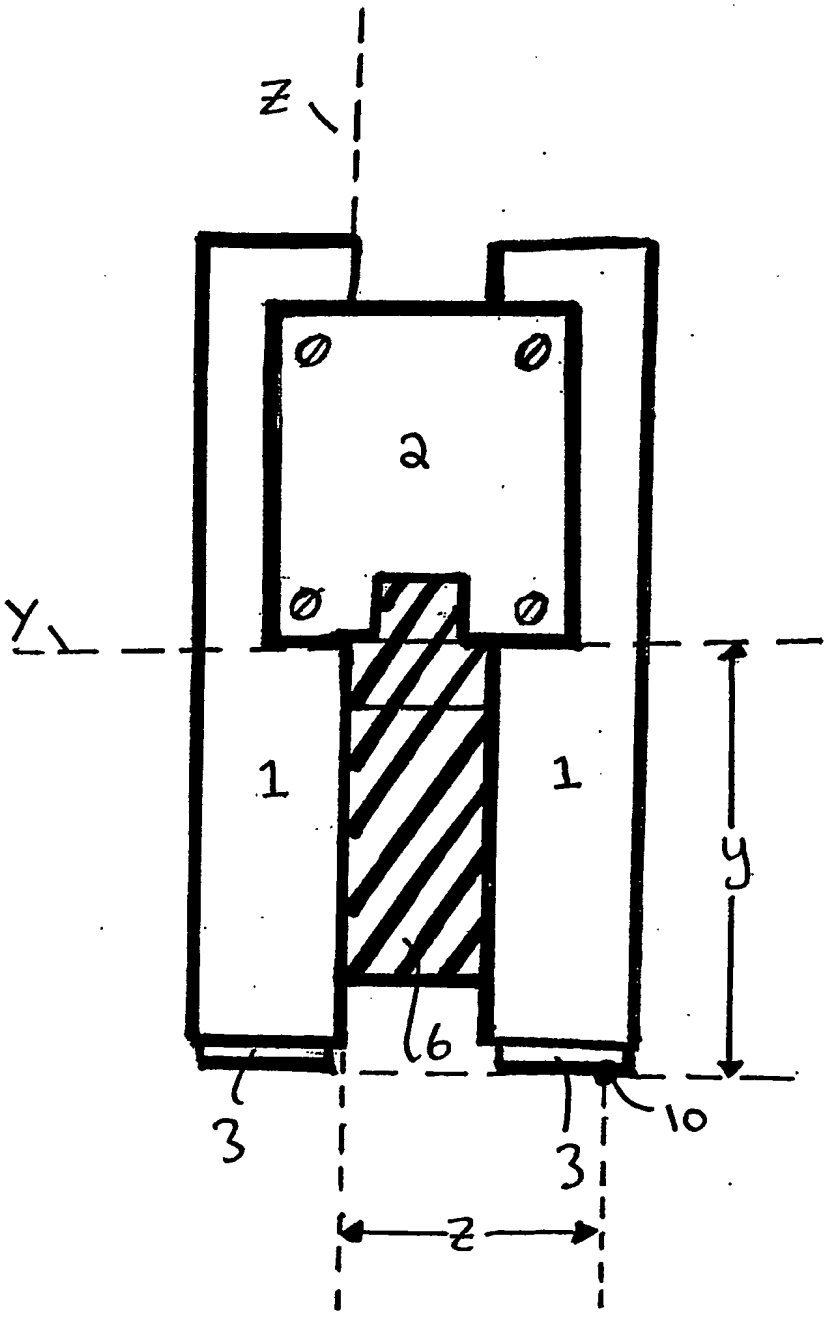

FIG. 2

INTERNATIONAL SEARCH REPORT

Inte nal Application No
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A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 B41J2/155 B41J2/05 B41J2/175

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 B41J

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5 049 898 A (ARTHUR ALAN R ET AL) 17 September 1991 (1991-09-17) abstract; figures column 4, line 35 -column 6, line 5	1,2,4,5, 7-10, 12-14
Y	column 6, line 37	6
X	EP 0 775 587 A (HEWLETT PACKARD CO) 28 May 1997 (1997-05-28)	1-5, 10-14
Y	abstract; figures column 2, line 14 -column 3, line 22 column 5, line 5 -column 6, line 50	6
Y	EP 0 875 379 A (HEWLETT PACKARD CO) 4 November 1998 (1998-11-04) abstract column 11, line 31 - line 34	6

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☒ Patent family members are listed in annex.

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4 September 2001	17/09/2001

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INTERNATIONAL SEARCH REPORT

ormation on patent family members

Inte nal Application No
PCT/EP 01/05596

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 5049898 A	17-09-1991	JP 2279344 A	15-11-1990
		JP 2933347 B	09-08-1999
EP 0775587 A	28-05-1997	US 5847722 A	08-12-1998
		DE 69609393 D	24-08-2000
		DE 69609393 T	07-12-2000
		JP 9174828 A	08-07-1997
EP 0875379 A	04-11-1998	US 5975677 A	02-11-1999
		JP 10309804 A	24-11-1998